CENTRAL INTELLIGENCE AGENCY

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PART II - REPORT

A. The EF-150 Medium Bomber

The EF-150 began as a design project in 1949 and a plywood mock-up of the aircraft was constructed during 1950. It differed from previous designs in having swept back wings, a fuselage circular in cross section and swept horizontal fin and tail-planes. The tail unit was strongly reminiscent of American practice with the tail-planes set well up on the vertical fin. [redacted] the safety factor of some of the most critical structural elements was as low as 1.8.

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In the original design the auxiliary landing gear retracted into the jet housings but after Russian criticisms (made when the project reached the mock-up stage) that excessive loadings would be imposed on the wing and nacelle structure, a re-design was ordered by BAADE and the auxiliary wheels were re-located at the wing tips, retracting into stream-lined housings similar in appearance to tip tanks.

Before the mock up was built the tail unit was modified by mounting the swept-back tail-plane at the tip of the vertical surface. The wings had a leading edge sweep of 35°, tapering to square tips. Two boundary layer fences were fitted on the upper surfaces. It was frequently stated by the Germans that the design owed much to the B-47 which they knew through the Western technical press. The fuselage was of circular cross section with an external diameter of 3 m. flattening towards the tail turret where the fuselage walls were almost vertical. Its overall length was 25 m. Anti-roll stabilisers were fixed on each side of the lower rear section of the fuselage, approximately 2 m. forward of the tail turret. These were of wood and fabric construction, 3 m. long with a maximum width of 1 m.

The crew compartment was pressurised to 0.6 atmospheres to simulate conditions at heights of 2,500 m. Transparent panelling was used for the nose section of the compartment which housed the navigator/bomb aimer. On the port side of the compartment staggered seats were arranged for the pilot and the radar operator. The radio operator/gunner had a backward facing seat on the starboard side. No provisions were made for a co-pilot. A pear-drop plexiglass canopy covered the cabin. Splinter-proof protection was afforded by a 10 mm. dural sheet floor running the full length of the compartment. Shaped protective armour of 15 mm. plate weighing approximately 450 Kg. was fitted in the backs of all seats.

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Twelve to fourteen months later the MIKULIN engines were removed and LYULKA axial-flow turbo jets of 5 metric tons thrust were installed. No reasons were given for the change-over but it was generally understood that it had been made on

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Russian instructions. The LYULKA engines were longer than the MIKULIN and of smaller external diameter but could be installed in the existing housings. With MIKULIN or LYULKA engines the ground clearance of the nacelles was limited and did not exceed 80 cm.

Both units of the tandem landing gear were fully retractable through 90° into the fuselage. The forward gear was steerable for taxi-ing, an automatic control being installed as a safety precaution to limit the traverse of the twin wheels at high speeds. To increase the angle of attack at take-off the legs of the rear landing gear could be retracted to a controlled extent. [redacted] a variation of 1.5° was possible. Single auxiliary wheels were used at the wing tips; these retracted rearwards through 90° into housings resembling large wing tip tanks. Dipl. Ing. Jakob ANTONI was responsible for the design and installation of the hydraulic system which was functioning well by 1951 despite initial teething troubles.

When the EF-150 project was first discussed the Russians proved to have definite ideas on the subject of aircraft armament [redacted] in this respect at least the design reflects Russian practice. A forward firing canon of 20 mm calibre (estimated) was mounted on the starboard side below the crew compartment. This was in a fixed mounting and hydraulically controlled. A two-gun retractable turret continued the fairing of the transparent panelling of the crew compartment. Under action conditions this turret was hydraulically extended approximately 80 cm. into the slipstream, a procedure which was unofficially criticised by the Germans who held that the handling characteristics of the aircraft would be impaired at high speeds. The tail turret had two co-axially mounted 20 mm. guns with 75° traverse and 60° elevation/depression. In flight the tail turret was to be permanently manned.

When the design office staff was working out the location of the controls and instruments in 1951 informant saw a wood and pasteboard mock up of a radar scanner which was to be fitted into the dome below the crew compartment. The angle of tilt was 3.5° and the scanner was rotatable through 360°. [redacted] the dome measured 3.5 m. x 1 m.

Ejection seats were provided for the navigator/bomb aimer, pilot, radio and radar operators. The navigator was ejected vertically downwards, the other crew members being ejected upwards at an angle of 15° from the vertical. Experiments were conducted at PODBEREZYE with weighted dummies during 1951 when the gear was found to function satisfactorily. The tests were carried out on the ground with the transparent panelling of the crew compartment removed.

Though BAADE and the leading members of the design staff at PODBERESYE probably received the results of the LUKOVITSY flight tests, no information was released [redacted] the EF-150 would have a range of 4,000 km. as a bomber or 5,500 km. as a reconnaissance machine with tanks fitted in the bomb-bay. [redacted] a maximum take-off weight of 52 tons (metric) mentioned [redacted] a take-off weight of 50 tons would be reasonable. On a rough flight plan sketched [redacted] the service ceiling is shown as 10,000 m. - 11,000 m. at a cruising speed of 950 km/hr., rising to 14,000 m. after 3,500 km. At 210 km/hr., the designed landing speed, the landing run would be 600 m. - 800 m.

The main fuel tank was fitted in the fuselage between the wing roots with four auxiliary tanks in the wings. Used as a reconnaissance aircraft the EF-150 would have long-range tanks mounted in the bomb-bay. The bay measured 6 m. x 1.5 m. x 1.5 m. and was fitted with two doors retracting inwards.

An emergency pump for the hydraulic system was fitted to assure the functioning of the powered controls in the event of a failure of the main pumps. This was driven by a SEPPELER propellor extended into the slipstream. A minimum dynamic

/pressure

pressure of 200 Kg/m^2 was [redacted] operation. A two-bladed propellor 950 mm. in diameter developed 25 h.p. at air speeds corresponding to Mach No. 0.97 at 6,000 m. Designed to revolve at 3,500-4,000 r.p.m. the propellor was filled with a centrifugally governed variable pitch mechanism allowing pitch settings of 30°-75°, the pitch coarsening from 30° when the propellor was extended into the slipstream to 75° at maximum r.p.m. Informant believes that the SEPPELER propellor was tested in this form in a Ju. 388.

Later, modifications which virtually amounted to a re-design were made to the unit to meet the operational requirements of the EF-150. Since higher air speeds were involved the propellor was extended into the slipstream with a coarser pitch setting (55°) to damp the initial torque effect on the driving shaft. At 1,800 r.p.m. the pitch had reverted to 30° and this setting was retained until the centrifugal governor came into action at 2,500 r.p.m. Modifications were made in the pump design by the hydraulics section at PODBEREZYE to step up the operating speed to 4,500 r.p.m. and a new propellor with wider blades was designed for high altitude operation.

A propellor allegedly fulfilling the operational requirements of the SEPPELER equipment was delivered at PODBEREZYE from a Russian factory. Wind tunnel tests were to be carried out on this propellor at TSAGI where a re-designed German propellor was also to be tested. In the event, the Germans never received the results of the tests since continual delays occurred at TSAGI where higher priority projects were being tunnel tested. Another drawback was the reluctance of the TSAGI authorities to put the propellors into the tunnel without some form of protective casing to guard against damage to the tunnel walls in the event of blade fractures.

[redacted] design the de-icing installation although [redacted] no previous experience in this matter. 25X1

From a study of the available literature [redacted] icing troubles could only arise during landing or take-off, since at operational altitude supercooled water vapour is not present in the atmosphere. 25X1

A rough calculation also shows that stagnation heat added to surface friction will prevent icing at speeds above 760 km/hr. [redacted] a similar estimate (720 km/hr) in a Russian publication. [redacted] establish a relationship between ice formation and speed, [redacted] utilise for his project data obtained previously in Germany on the Ju52 and Ju88 aircraft. [redacted] 25X1 25X1 25X1 25X1

From these experiments a formula was deduced for the quantity of heat required to prevent icing. As far as source remembers, the proposed formula was of the form: 25X1 25X1

$$Q = F\,v\,K\,t\,/\,200$$

where

Q	=	quantity of heat in K/cal/hour
v	=	air speed in Km/hours
F	=	surface to be de-iced (in M^2)
t	=	temperature below zero (°C)
K	=	a factor, depending on nature of surface (smooth, ribbed, etc).
200	=	empirical factor.

/Although 25X1

[redacted] 25X1

[redacted] this formula since it "lacked a physical basis", [redacted] used it for the layout, limiting, however, the air speed to those likely to occur during take-off and landing (i.e. whilst aircraft would be passing through supercooled strata). 25X1

According to the manufacturers of the jet engines supplied for the 150, a maximum of 5% of the total air consumption could be used for de-icing.

[redacted] at which compressor stage the air would be tapped, [redacted] the maximum pressure and temperature of the air at this point was 2.56 atmosphere and 215°C. This pressure and temperature can be maintained during take-off (climbing). 25X1

When landing, however, the engine revolutions would be insufficient to provide air at this temperature unless the thrust is artificially increased (landing flaps and extended undercart).

Even under these conditions, [redacted] the temperature of the air tapped off would drop to about 150°C [redacted] barely sufficient. 25X1

The layout of the de-icing plant is shown in Appendix 'C'. UNCODED 25X1

The two air tappings a and b are joined by a pipe

b c g h a 60 mm diameter

at c, g and h are T pieces.

Connections c and h are so adjusted, that 80% of the air coming from b will take the path c d e and only 20% the path c g n (pipe g n is 40 mm diameter).

The same applies to the air coming from a. The air taking the path c d e and h l m respectively is used for deicing of the wing nose, whilst the remainder of the air taking the path g n warms the tail plane. The temperature of the air at e and m will be of the order of 200°C at full power and 150°C when landing.

Such a temperature might damage the light alloy wing structure if the air were allowed to impinge directly on the metal. For this reason the air is first cooled to about 90°C by mixing it with cold air before it is introduced into the double skin of the wing nose (see Appendix 'C').

The ejector producing the mixing is placed at a distance of 5 m from the wing root and 8 m from the wing tip (i.e. just beyond the power plant). It will be noticed that the wing nose is divided into 2 portions, a nose "tube" only about 120 m/m diameter formed by the auxiliary spar and nose proper and a "mixing" chamber between auxiliary and front spar. Experiments were carried out with this installation by painting the outside with paraffin wax and introducing hot air supplied by the 4th compressor stage of a 004 engine. The object of the test was to ensure a uniform temperature distribution and this was finally achieved. After this, the de-icing installation was accepted by the Russians with the proviso that such tests did not suffice to demonstrate the efficiency of the plant under practical (icing) conditions. Source has no information on the performance of the installation.

Subsequently to this work, [redacted] a report of Prof. OSTOSLAVSKIY who had carried out de-icing experiments at RAMENSKOYE. In these experiments samples of the surface requiring deicing were attached to the fuselage of an aircraft and warm air supplied from the engine. The conditions resembled those of the earlier JUNKERS experiments already referred to and similar results were obtained as to the quantity of heat required. 25X1

/B. VEB

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[redacted] 25X1

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B. VEB SCHIFFSWERFT - ROSSLAU [redacted] 25X1
(Germany - Russian Occupied Zone).

During 1954 trials were carried out at the state-controlled shipyard, ROSSLAU, with a 10 m. experimental hydrofoil boat at speeds of 16 m/sec., 20 m/sec., and 24 m/sec. to test the handling of the craft and to check design office calculations. On the basis of the trials with the 10 m. craft construction was begun on a full size 25 m. craft which was partially completed when informant left ROSSLAU early in January, 1955.

No direct Russian interest was shown in the project which was given the code-name "Forelle", but the details of the 10 m. boat and the trials results had been submitted to an acceptance commission headed by Admiral WERNER of the VPS (Volkspolizei-See).

From the partially completed boat at ROSSLAU [redacted] when the project was in the design study stage, [redacted] the boat would be flat hulled, powered by two engines of approximately 800 s.h.p. each, and fitted with twin five-bladed propellors. Speeds of the order of 45 knots were envisaged in the design study. 25X1

Provisions were made in the design for two symmetrically mounted torpedo tubes amidships and an anti-aircraft cannon, possibly mounted in an aircraft-type turret, located aft of the perspex-covered wheelhouse.

Originally the 25 m. boat was to be powered by two Russian W.2. engines developing 2 x 600 plus h.p. developed from a Hispano-Suiza design. An alternative power plant considered was the Ju 205, a six cylinder (12 horizontally opposed pistons) developing approximately 800 h.p. Of the two the Russian engine with its dry weight of less than 840 kg. was more favourably regarded, especially in view of its sturdy construction, relative simplicity and proven reliability. In the event the Russians delayed delivery of the W.2. and it was proposed to substitute two engines of 500 h.p. developed from a Daimler Benz design in the Volkseigener Betrieb, at LICHTENFELDE, controlled by the Ministry of Mechanical Engineering.

[redacted] ROSSLAU in January 1955 one partially completed 25 m. craft was on the stocks. Construction was relatively slow since ROSSLAU had no facilities for anodising light-alloy sheet and components which had to be sent to ROSTOCK for processing. This boat would probably be ready for prototype trials in May/June 1955. 25X1 25X1

[redacted]

Cavitation is the name given to the production of discontinuities inside a previously continuous liquid medium. These discontinuities are hollow spaces filled with air and vapour. The first bubbles are no doubt due to the previously dissolved air coming out of solution as the pressure falls. Into this space the liquid will evaporate at a rate depending on its vapour pressure and this will become the deciding factor determining the growth of the discontinuity.

/As a result

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[redacted]

[redacted] 25X1

As a result, the cavitation factor is defined as

$$\sigma = \frac{p - v}{q}$$

where p = static pressure of undisturbed liquid

v = vapour pressure of the liquid at the reigning temperature

q = stagnation pressure of undisturbed liquid.

[redacted] published work on the subject making special use of the well-known collective publication entitled "Hydrodynamic Problems of Ship Propulsion" published in 1932. 25X1

It appears from these investigations that in the case of propellors cavitation becomes important when σ falls to about ·2. It is, however, possible to operate, although very inefficiently with σ as low as ·03 (so-called region of super-cavitation, where the discontinuities separate from the blades and collapse some distance behind the propellor).

[redacted] similar conditions also apply to gliding surfaces and points out that the speed boat records (180 mph) imply cavitation numbers of the order of ·03. 25X1

If the boat step is indeed operating at this cavitation number, an unstable [redacted] 25X1 operation is likely to result, leading to porpoising and loss of control. [redacted] the two fatal accidents which occurred in 1954 whilst attempting to establish speed records were due to this phenomenon. [redacted] 25X1

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PART III- ANNEXES

Appendix 'A'.
Appendix 'B'.
Appendix 'C'.

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TO:

Appendix 'C'. [redacted] SECRET

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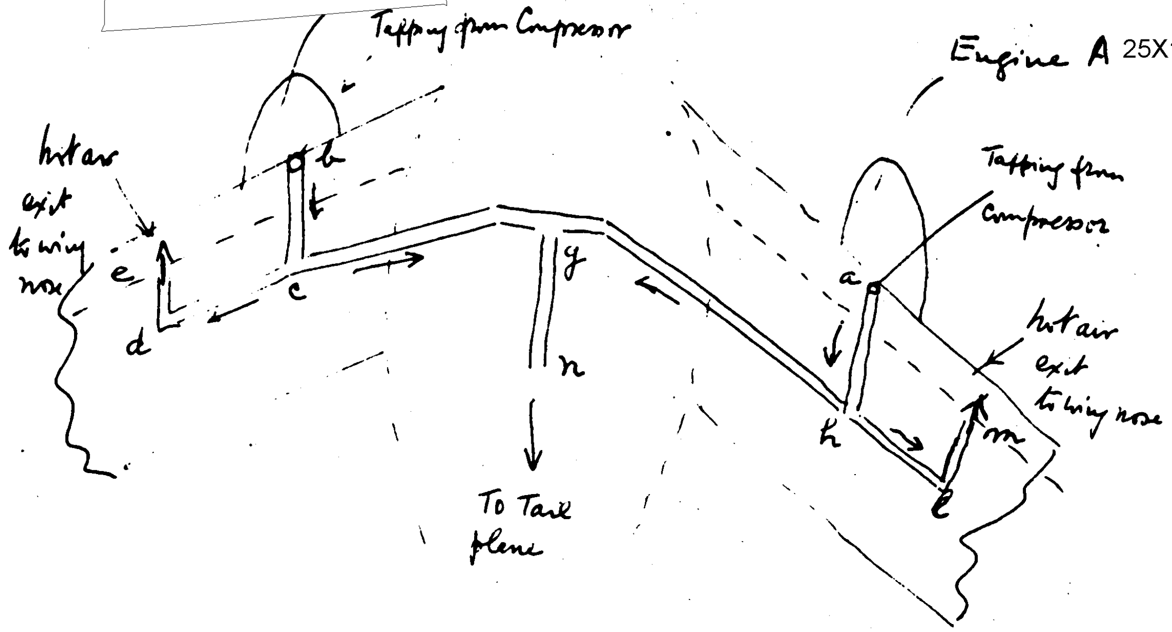

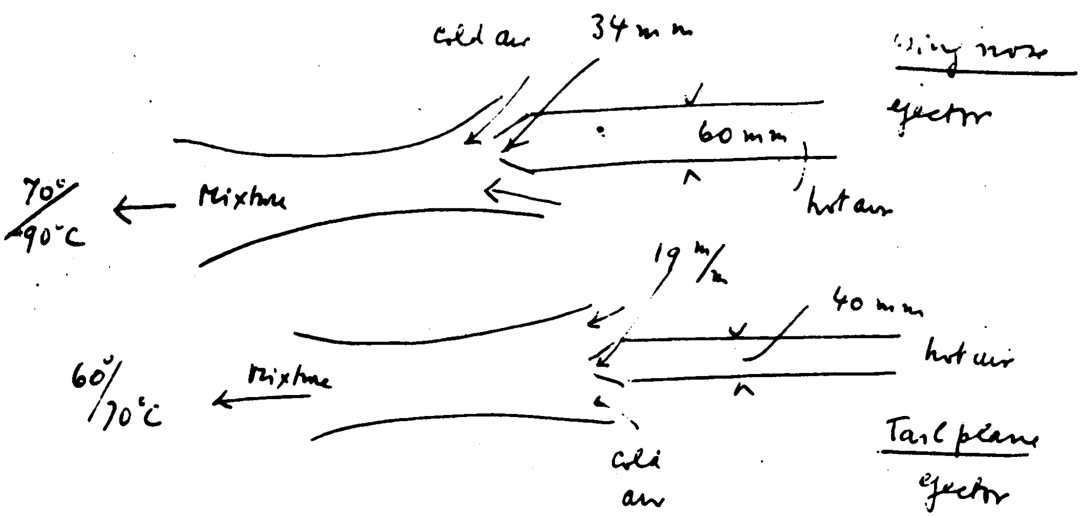

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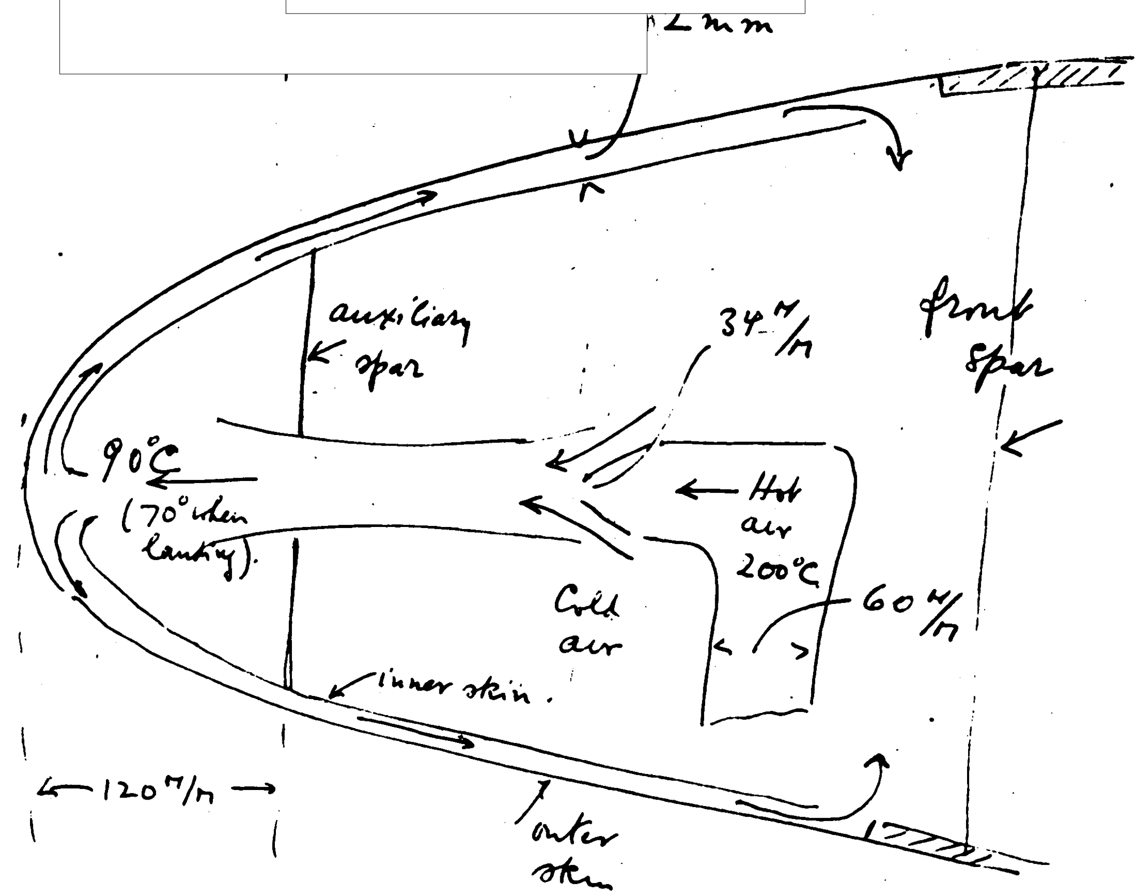
Appendix 'B' [redacted] 25X1

[redacted] 25X1



Wing Nose Deicing
Path of air.

Note. Similar method applied to tailplane
Temperature of air entering slot is however
only 70° in this case (reduced to 60° during
landing).

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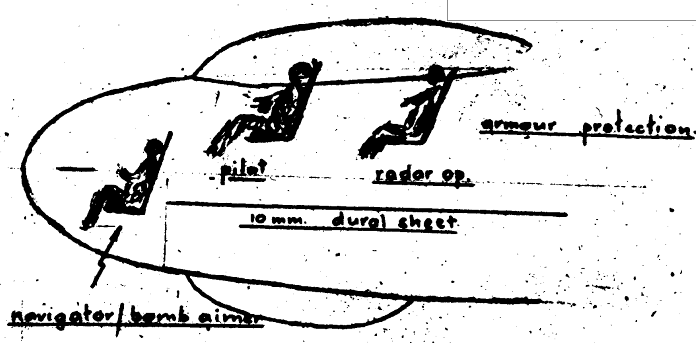
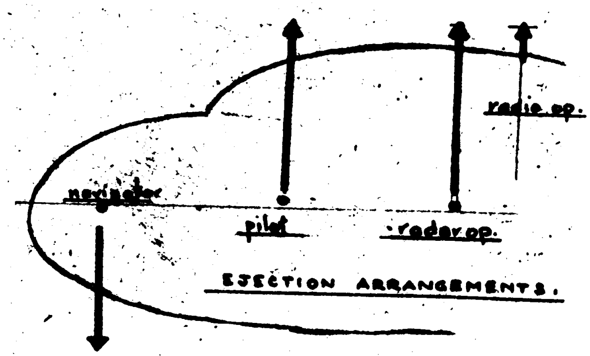
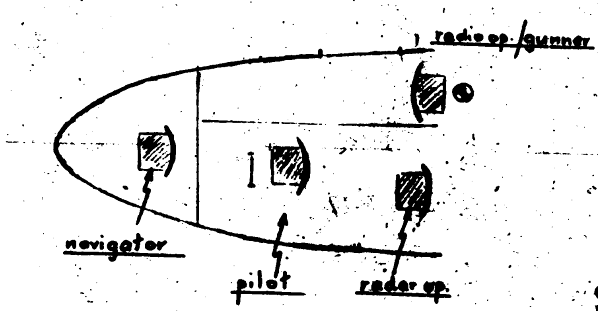
S E C R E [redacted] 25X1

Appendix 'A' [redacted] 25X1

[redacted] 25X1







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